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DIPHTHERIA CARRIERS AMONG MASSACHUSETTS SCHOOL CHILDREN

EDITH BECKLER; HELEN GILLETTE, AND MARY PARKER
BOSTON

From the Bacteriological Laboratory of the Massachusetts Department of Public Health

A study of nose and throat cultures from over 8,000 school children of Massachusetts, from 5 to 15 years of age, has been made during the past year and a half. The cultures were taken in 35 cities and towns throughout the state, as a rule, under the direction of the school physicians. Nose and throat cultures were taken from each child. They were taken because a noticeable number of cases of diphtheria had occurred in the schools. They would, therefore, be considered contact cultures although probably many of the pupils did not come in contact with the cases. In some instances cultures were taken from all the pupils in a school, in others, from the pupils in a single room, when the cases were limited to one room.

The 8,389 cultures received were grown on Loeffler's blood serum having a P_H value of 7.2. After from 14 to 18 hours' incubation at 34° C. they were examined for diphtheria bacilli, the smears being stained with Loeffler's methylene blue. All of the cultures were examined by the same bacteriologists. Of the 8,389 cultures examined, 41 positives were obtained, or approximately 0.49%. The highest percentage of positives in any one group was 13, when 4 positives were found in 31 cultures from one school room.

Virulence tests were made on 38 cultures isolated. Unfortunately, the other 3 cultures were lost before tests could be made. Guinea-pigs weighing from 200 to 300 gm. were inoculated subcutaneously with 1 c.c. of a 48-hour broth culture of the bacillus, the control animal receiving 500 units of diphtheria antitoxin before the broth culture. Two of the 38 cultures tested were found to be nonpathogenic. Approximately 95% were virulent, killing the unprotected guinea-pigs in from 48 to 60 hours.

There was no evidence that cultures diminished in virulence, because some of the cultures had been grown on artificial mediums for 6 months without losing their virulence.

Many diphtheroid bacilli were encountered during the examinations. The familiar Hofmann bacillus gave little trouble but other bacilli more closely resembling diphtheria bacilli were frequently found. In these bacilli polar granules were often observed, but when studied in young cultures they were found to show deviations from the true diphtheria bacillus, especially in the grouping and rate of growth. As it is the custom of this laboratory to examine and report on young (2-8 hour) cultures of diphtheria bacilli in the routine diagnosis of diphtheria, the laboratory workers are very familiar with the appearance of young diphtheria forms. Therefore, differences were readily noted in the case of diphtheroids, and it was not necessary to delay the report of the school cultures more than a few hours. Certain bacilli resembling the B form of Wesbrook's types have been tested in the past for virulence and all have been found avirulent for guinea-pigs. These somewhat suspicious bacilli have been considered by us as diphtheroids, not avirulent diphtheria bacilli. The two cultures tested which did not kill the guinea-pigs may have been avirulent diphtheria bacilli because in morphology and cultural characteristics they appeared typical, but it is quite possible that they were distinct species and that, had we been more discriminating, morphologic differences from the true diphtheria bacillus might have been noticed. Our opinion is that avirulent diphtheria bacilli are rare. The results obtained by us are quite different from those of some other observers, notably Moss, Gelian and Guthrie,¹ who found 85 positive throat cultures among 800 school children of Baltimore, and of the 64 cultures tested 87.5% were avirulent. However, it does not seem safe to assume a similar distribution elsewhere. Examination of over 6,000 contacts made by us in 1915 showed only 0.6% positive. It would appear that among large groups of school children in Massachusetts less than 1% harbor diphtheria bacilli, virulent and avirulent.

We are aware of the fact that a single culture from a throat is not conclusive evidence, but there has been no epidemiologic evidence that we have missed many carriers; in most instances, isolation of the carriers detected has led to a cessation of the cases in the schools. Some of the carriers reported were said to show some symptoms of diphtheria and were actually missed cases rather than healthy carriers. The sphere of influence of one carrier or missed case seems to be

¹ Bull. Johns Hopkins Hosp., 1920, 31, p. 388.

considerable and the detection of the relatively small number of these leads to a diminution of the cases occurring in the schools. The taking of school cultures appears to be of distinct value.

SUMMARY

In Massachusetts, school children, among whom cases of diphtheria occurred, showed a small number of carriers of virulent diphtheria bacilli. Of a total of 8,389, only 41 or approximately 0.49% positive cultures were obtained. Of the 38 cultures tested for virulence, approximately 95% were virulent.

Avirulent diphtheria bacilli, said to be common in some places, are uncommon in this state. Only 2 cultures were found which were considered identical with the diphtheria bacillus in morphology.

Diphtheroid bacilli are common, but a careful study of the morphology and cultural characters shows differences from the true diphtheria bacillus and makes many virulence tests unnecessary. Familiarity with young cultures of diphtheria and diphtheroid bacilli is very helpful.